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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,964	05/19/2004	Shriram Ramanathan	42P19016	8073

59796 7590 04/14/2009

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EXAMINER	
DINH, BACH T	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
04/14/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/849,964	Applicant(s) RAMANATHAN ET AL.	
	Examiner BACH T. DINH	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _24 November 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _6,8-11 and 21-25_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _6, 8-11 and 21-25_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Summary

1. This is the response to the communication filed on 11/24/2008.

2. Claims 6, 8-11 and 21-25 remain pending in the application.

3. All of previous rejections are withdrawn in view of applicant's amendment to the claims.

4. The amendment did not place the application in condition for allowance.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 6 and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,804,966) in view of Rabin et al. (WO 03/046265).

Addressing claim 6 and 8-10, Chu discloses a thermoelectric package (figures 1-3B), comprising:

A microelectronic die (electronic device 12) having at least one area of which is of a higher heat dissipation rate than the remainder of the microelectronic die when in operation (figures 2A-2C, high heat flux area 13 and the remaining lower heat flux area of device 12);

A plurality of thermoelectric elements disposed at highest density in the high heat flux area 100A and 100B and lower density at the low heat flux area 110 (figures 3A-3B, 6:40-67).

Chu is silent regarding a first electrode proximate to the microelectronic die, a dielectric material proximate to the first electrode, a second electrode opposing the first electrode with the dielectric material disposed therebetween, a plurality of nano-wires extending between the first electrode and the second electrode and a lower density proximate to an intermediate area between the area of higher heat dissipation rate and the remainder of the microelectronic die.

Rabin discloses a thermoelectric cooling device (figures 8-9); wherein, the thermoelectric cooling device comprises of:

A first electrode proximate the higher heat area (high temperature electrode 260);

A dielectric material proximate the first electrode (porous alumina body 220, 13:26-31);

A second electrode opposing the first electrode with the dielectric material disposed therebetween (electrodes 230); and

A plurality of nano-wires extending between the first electrode and the second electrode (p-type and n-type bismuth containing nanowires 222 and 224, 9:25-31, 13:32-14:2).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Chu with the thermoelectric cooling device of Rabin because the cooling device of Rabin is capable of dissipating heat from one area to another (Rabin, 12:20-13:7). Furthermore, one would have found it obvious to adjust the density of the thermoelectric nano-wires to have a higher density proximate to the area of high heat flux 13, a lower density proximate to an intermediate area of lower heat flux and a further lower density proximate to the area of lowest heat flux on the electronic device 12 because Chu discloses that adjusting the density of the thermoelectric nano-wires according to the amount of heat flux would provide more uniform temperature distribution (Chu, 7:1-12). Therefore, adjusting the density of the thermoelectric nano-wires to include a region with intermediate density between the area of highest heat flux and lowest heat flux is well within the technical grasp of one with ordinary skill in the art.

Addressing claim 11, Rabin discloses a negatively charged trace electrically connected to the first electrode (for cooling function as described in figure 8A, the negatively charged p-type nanowires 222 are connected to the electrode 260) and a positively charged trace to the second electrode (in figure 8A, the n-type nanowires 224 are positively charged, 12:29-13:7).

8. Claims 6, 8-11 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Connor et al. (US 2002/0145194) in view of Rabin et al. (WO 03/046265) and Chu et al. (US 6,804,966). Chu is cited and relied on for the first time in this office action, its use is necessitated by applicant's amendment to the claims.

Addressing claim 6 and 8-10, O'Connor discloses a thermoelectric package (figures 3a-3c), comprising:

A microelectronic die (die 40) having at least one area of which is of a higher heat dissipation rate than the remainder of the microelectronic die when in operation (figures 7a-7b);

O'Connor further discloses the heat spreading layer of microelectronic die 40 is made up of nanotubes [0048] and the heat spreading layer must be thermally connected to the areas of the die that will generate the most heat [0042];

In figure 7a, O'Connor also discloses the microelectronic die 40 has area of highest heat dissipation rate (100-110 ^{o}C), areas of intermediate heat dissipation rate (60-100^{o}C) and area of low heat dissipation rate (50-60 ^{o}C) or the remainder of the microelectronic die.

O'Connor fails to disclose a first electrode proximate the microelectronic die including the higher heat area, a dielectric material proximate the first electrode, a second electrode opposing the first electrode with the dielectric material disposed therebetween, and a plurality of nano-wires extending between the first electrode and the second electrode, wherein the plurality of nano-wires comprise a higher density proximate to the area of higher heat dissipation rate, a lower density proximate to an intermediate area between

the area of higher heat dissipation rate and the remainder of the microelectronic die, and a further lower density proximate to the remainder of the microelectronic die.

Rabin discloses a thermoelectric cooling device (figures 8-9); wherein, the thermoelectric cooling device comprises of:

A first electrode proximate the higher heat area (high temperature electrode 260);

A dielectric material proximate the first electrode (porous alumina body 220, 13:26-31);

A second electrode opposing the first electrode with the dielectric material disposed therebetween (electrodes 230); and

A plurality of nano-wires extending between the first electrode and the second electrode (p-type and n-type bismuth containing nanowires 222 and 224, 9:25-31, 13:32-14:2).

Chu discloses a thermoelectric assembly; wherein, the density of the thermoelectric elements is adjusted according to the degree of heat flux at different area of an integrated circuit chip 12 (figures 3A-3B, 6:40-67, denser thermoelectric elements in higher heat flux areas 100A and 100B and less dense thermoelectric elements at area of lower heat flux 110).

O'Connor and Rabin are analogous arts for they disclose heat dissipating devices. At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of O'Connor with the thermoelectric cooling device of Rabin because the cooling device of Rabin is capable of dissipating heat from one area to another (Rabin, 12:20-13:7).

Furthermore, one would have found it obvious to modify the device of O'Connor by adjusting density of the thermoelectric elements according to the temperature profile as disclosed by Chu because doing so would allow for lower circuit temperature for a given heat load to be established, provide a more uniform temperature distribution across the electronic device and improve the efficiency of the thermoelectric assembly (Chu, 7:5-13). Specifically, one would dispose the thermoelectric elements at highest density at the area of highest heat flux, medium density at the area of intermediate heat flux and lowest density at remaining area of lowest heat flux according to the temperature profile of O'Connor (figure 7a).

Addressing claim 11, Rabin discloses a negatively charged trace electrically connected to the first electrode (for cooling function as described in figure 8A, the negatively charged p-type nanowires 222 are connected to the electrode 260) and a positively charged trace to the second electrode (in figure 8A, the n-type nanowires 224 are positively charged, 12:29-13:7).

Addressing claims 21-24, O'Connor discloses an electronic system (figure 1), comprising:

An external substrate within a housing (circuit board of the electronic assembly within a housing for computers, wireless communication devices or entertainment devices, 1:12-27); and

At least one microelectronic device package (integrated circuit package disclosed in figures 3a-3c) attached the external substrate (integrated circuit is physically and electrically coupled to the circuit board, 1:12-27). In figures 3a-3c, O'Connor discloses the integrated circuit package includes a die 40 comprises of a heat spreading layer 100, which can be made of nanotubes (6:45-47), and the heat spreading layer must be thermally connected to the areas of the die that will generate the most heat [0042];

An input device interfaced with the external substrate (figure 1, keyboard/controller 20);

A display device interfaced with the external substrate (figure 1, display 8);

All the components are interfaced via a system bus 2; and

In figure 7a, O'Connor also discloses the microelectronic die 40 has area of highest heat dissipation rate (100-110 ^{o}C), areas of intermediate heat dissipation rate (60-100 ^{o}C) adjacent to the area of highest heat dissipation rate and area of low heat dissipation rate (50-60 ^{o}C) or the remainder of the microelectronic die.

O'Connor fails to disclose a thermoelectric device including:

A first electrode;

A dielectric material proximate the first electrode;

A second electrode opposing the first electrode with the dielectric material disposed therebetween; and

A plurality of nano-wires extending between the first electrode and the second electrode, wherein the plurality of nano-wires comprise a higher density proximate to an area of higher heat dissipation rate of the microelectronic die when in operation, a lower

density proximate to an intermediate area adjacent to the area of higher heat dissipating rate, and a further lower density proximate to the remainder of the microelectronic die.

Rabin discloses a thermoelectric cooling device (figures 8-9); wherein, the thermoelectric cooling device comprises of:

A first electrode proximate the higher heat area (high temperature electrode 260);

A dielectric material proximate the first electrode (porous alumina body 220, 13:26-31);

A second electrode opposing the first electrode with the dielectric material disposed therebetween (electrodes 230); and

A plurality of nano-wires extending between the first electrode and the second electrode (p-type and n-type bismuth containing nanowires 222 and 224, 9:25-31, 13:32-14:2).

O’Connor and Rabin are analogous arts for they disclose heat dissipating devices. At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of O'Connor with the thermoelectric cooling device of Rabin because the cooling device of Rabin is capable of dissipating heat from one area to another (Rabin, 12:20-13:7).

Furthermore, one would have found it obvious to modify the device of O’Connor by adjusting density of the thermoelectric elements according to the temperature profile as disclosed by Chu because doing so would allow for lower circuit temperature for a given heat load to be established, provide a more uniform temperature distribution across the electronic device and improve the efficiency of the thermoelectric assembly (Chu, 7:5-

13). Specifically, one would dispose the thermoelectric elements at highest density at the area of highest heat flux, medium density at the area of intermediate heat flux and lowest density at remaining area of lowest heat flux according to the temperature profile of O'Connor (figure 7a).

Addressing claim 25, Rabin discloses a negatively charged trace electrically connected to the first electrode (for cooling function as described in figure 8A, the negatively charged p-type nanowires 222 are connected to the electrode 260) and a positively charged trace to the second electrode (in figure 8A, the n-type nanowires 224 are positively charged, 12:29-13:7).

Response to Arguments

9. Applicant's arguments with respect to claims 6, 8-11 and 21-25 have been considered but are moot in view of the new ground(s) of rejection.

Chu discloses that the density of the thermoelectric element is adjusted according to the degree of heat flux in different areas of an electronic device (figures 3a-3b). Such adjustment would give one many advantages disclosed in column 7 lines 1-12. Therefore, the disclosure of Chu gives one with ordinary skill in the art the motivation to modify the density of thermoelectric elements in any areas with different temperature of an electronic device in order to form uniform temperature distribution.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BACH T. DINH whose telephone number is (571)270-5118. The examiner can normally be reached on Monday-Friday EST 7:00 A.M-3:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BD
04/08/09

/Alex Noguerola/
Primary Examiner, Art Unit 1795
April 9, 2009